A COMPARISON BETWEEN A COMMERCIAL CRICKET GUT-LOADING DIET AND A POULTRY LAYER GRAIN IN PROXIMATE, MINERAL, AND VITAMIN COMPOSITION

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Abstract

Calcium and vitamin A deficiencies in amphibians can threaten the health of captive collections. Metabolic bone disease, a result of inadequate calcium or improper calcium to phosphorus ratios, causes skeletal weakness, fracturing, poorly mineralized bones, and muscle spasms (Ferrie *et al*., 2014; McWilliams, 2008). Deficiencies in vitamin A can cause "short tongue syndrome", poor immune health, low tadpole survival rates, and low reproductive success (Ferrie *et al*., 2014; McWilliams, 2008). Both appear to be caused by low vitamin A and calcium concentrations in common feeder species. Typically, commercially available gut-loading diets and dusting treatments are used to compensate for these deficiencies. These gut-loading diets include supplemented calcium to balance the Ca:P ratio and vitamin A to prevent hypovitaminosis A. Much like these feeder cricket diets, poultry layer grains also provide supplemental calcium and vitamin A to increase reproductive success. However, there is substantial difference in price between poultry layer grain and commercial feeder cricket diets. The poultry grain and commercial gut-loading cricket diets used at Omaha's Henry Doorly Zoo and Aquarium (OHDZA) cost $0.32 per lb. and $1.59 per lb., respectively. If layer grain provides similar supplementation to a cricket diet, then layer grain could be a more economical gut-loading options for facilities that use feeder crickets. Following a 24-hr gut load with layer grain, commercial cricket diet, or produce mix, samples were collected to analyze each treatment for comparison. Proximate nutrients, minerals, and vitamin A as retinol and beta-carotene were measured for the different diets. While vitamin A concentrations in layer grain and in commercial gut-load diets are similar, the calcium concentration of the gut-load diet is higher than that of the layer grain, and these differences were reflected in the gut-loaded crickets.

Methods

For a 24 hour period, adult 1" crickets (The Bug Company, Ham Lake, MN) were given free access to fresh water and one of three gut-loading treatments; 1:1:1 ratio of kale, carrot, sweet potato by weight (CON), Purina Layena ground to 1 mm particle size (Purina Animal Nutrition, Gray Summit, MO; LAY), and Zeigler Monster Hi Cal Cricket Diet (Zeigler Bros, Inc., Gardners, PA; MON). Crickets were analyzed for proximate nutrient constituents in-house. Specifically, dry matter (DM), organic matter (OM), crude protein (CP), and crude fat (CF) were measured. Minerals were analyzed at a contract laboratory (Midwest Labs, Omaha, NE) following methods described by the Association of Official Agricultural Chemists (AOAC). Vitamin A analyses were also conducted by Midwest Labs using guidelines by the American Association for Clinical Chemistry (AACC).

Results

Table 1 shows results for feeder crickets gut-loaded with CON, LAY, and MON, respectively. Table 2 shows proximate, mineral, and vitamin A analyses for diet items fed to treatment groups.

Discussion

The vitamin A concentrations of LAY and MON are similar, while the calcium content of MON is higher, giving a more balanced Ca:P ratio. This is expected because the calcium content of the commercial cricket diet is higher than the other two treatments. With these results, it is important to remember that many institutions, including OHDZA, have a dusting schedule for their feeder crickets in addition to gut-loading. While MON has a higher calcium content following the gut-loading period, it may be possible to improve the Ca:P imbalance in LAY with appropriate dusting. The remaining proximates and minerals are similar across all three treatment groups, with the exception of iron and manganese. The high concentration of vitamin A as beta-carotene in CON suggests that adding high-carotenoid produce to a rotating gut-load schedule may alleviate some concern of vitamin A deficiencies in feeder crickets. Each diet offers different nutrients that can be absorbed by feeder crickets. Further research into the effects of dusting crickets fed a more economical gut-loading diet, like poultry layer grain, is required to draw concrete conclusions.

Literature Cited

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Table 1. Effect of diet on proximate nutrient constituents[1], mineral concentrations[2], and vitamin A concentrations[2] of feeder crickets.

		Dietary Treatments		
Paramater	**Unit[3]**	**CON**	**LAY**	**MON**
DM	%	29.3	27.8	29.2
OM	%	95.2	95.1	92.7
CP	%	66.1	64.0	63.5
CF	%	19.7	20.6	19.4
Ca:P		0.14	0.26	1.08
S	%	0.57	0.53	0.52
P	%	0.94	0.92	0.96
K	%	1.24	1.13	1.15
Mg	%	0.11	0.11	0.14
Ca	%	0.13	0.24	1.04
Na	%	0.44	0.39	0.39
Fe	ppm	60.6	70.1	150.0
Mn	ppm	38.1	58.1	76.0
Cu	ppm	26.5	27.6	27.8
Zn	ppm	244	241	242
Retinol	IU/100 g	< 3	< 3	201
Beta-carotene	IU/100 g	20000	2000	1800

[1]Analyses conducted by the Nutrition Department at Omaha's Henry Doorly Zoo and Aquarium

[2]Analyses conducted by Midwest Laboratories.

[3]All values on a Dry Matter Basis

[4]Control Diet: 1:1:1 ratio of kale, carrot, sweet potato by weight

[5]Purina Layena Diet ground to 1 mm particle size

[6]Zeigler Monster Hi Cal Cricket Diet

Table 2. Proximate nutrient constituents, mineral concentrations, and vitamin A concentrations of each diet item fed to crickets.

		Dietary Treatments		
Paramater	**Unit[1]**	**CON[2,3]**	**LAY[3,4]**	**MON[5,6]**
DM	%	82.5	88.0	92.8
OM	%	91.4	92.0	71.7
CP	%	13.71	18.2	21.9
CF	%	4.70	2.84	2.24
Ca:P		2.71	8.35	9.45
P	%	0.34	0.51	1.10
K	%	2.92		1.08
Mg	%	0.16		0.27
Ca	%	0.92	4.26	10.40
Na	%	0.38	0.63	0.30
Fe	ppm	65.9		446.0
Mn	ppm	38.0	113.6	300.0
Cu	ppm	4.9		24.0
Zn	ppm	220		218
Retinol	IU/100 g	0	250	80[3]
Beta-carotene	IU/100 g	54850		

[1]All values on a Dry Matter Basis
[2]Control Diet: 1:1:1 ratio of kale, carrot, sweet potato by weight
[3]USDA Food Database
[4]Purina Layena Diet ground to 1 mm particle size
[5]Guaranteed analysis by manufacturer
[6]Zeigler Monster Hi Cal Cricket Diet
[7]2008 analysis by Midwest Laboratories unless otherwise noted.